

Low-Voltage, 1 Ω SPDT Analog Switch

FSA4157, FSA4157A

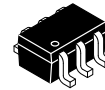
Description

FSA4157 and FSA4157A are high performance Single Pole/Double Throw (SPDT) analog switches. Both devices feature ultra low R_{ON} of 1.15 Ω maximum at 4.5 V V_{CC} and operates over the wide V_{CC} range of 1.65 V to 5.5 V for FSA4157, and 2.7 V to 5.5 V for FSA4157A. The device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation. The select input is TTL level compatible.

The FSA4157A features very low quiescent current even when the control voltage is lower than the V_{CC} supply. This feature services the mobile handset applications very well allowing for the direct interface with baseband processor general purpose I/Os.

Features

- FSA4157A Features Lower I_{CC} when the S Input is Lower than V_{CC}
- Maximum 1.15 Ω On Resistance (R_{ON}) at 4.5 V V_{CC}
- 0.3 Ω Maximum R_{ON} Flatness at 4.5 V V_{CC}
- Space-Saving 6-lead, MicroPak™ and SC70 6 Packages
- Broad V_{CC} Operating Range:
 - ◆ FSA4157: 1.65 V to 5.5 V
 - ◆ FSA4157A: 2.7 V to 5.5 V
- Fast Turn-On and Turn-Off Time
- Break-Before-Make Enable Circuitry
- Over-Voltage Tolerant TTL-Compatible Control Circuitry
- These Devices are Pb-Free and are RoHS Compliant

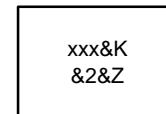


SC-88 (SC-70 6 Lead), 1.25x2
 CASE 419AD



SIP6 1.45X1.0
 CASE 127EB

MARKING DIAGRAM



- xxx = Specific Device Code (A57, EG, B57, EU)
- &K = 2-Digits Lot Run Traceability Code
- &2 = 2-Digit Date Code
- &Z = Assembly Plant Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

FSA4157, FSA4157A

ORDERING INFORMATION

| Part Number | Top Mark | Package | Shipping† |
|-------------|----------|--|--------------------|
| FSA4157P6X | A57 | SC-88 (SC-70 6 Lead), 1.25x2 (Pb-Free) | 3000 / Tape & Reel |
| FSA4157L6X | EG | SIP6 1.45X1.0 (Pb-Free) | 5000 / Tape & Reel |
| FSA4157AP6X | B57 | SC-88 (SC-70 6 Lead), 1.25x2 (Pb-Free) | 3000 / Tape & Reel |
| FSA4157AL6X | EU | SIP6 1.45X1.0 (Pb-Free) | 5000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PIN CONFIGURATIONS

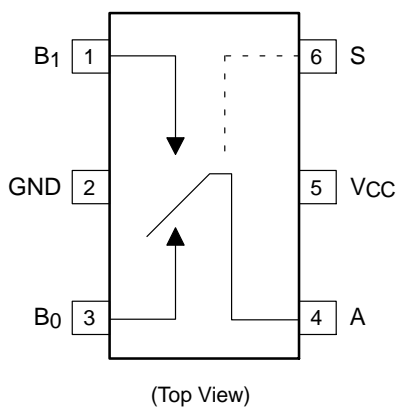


Figure 1. SC70 Pin Assignments

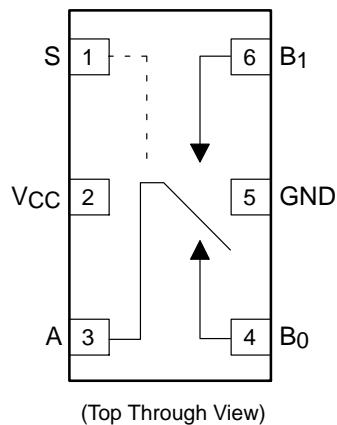


Figure 2. MicroPak Pin Assignments

PIN DEFINITIONS

| Pin# SC70 | Pin# MicroPak | Name | Description |
|-----------|---------------|-----------------|----------------|
| 1 | 6 | B1 | Data Ports |
| 2 | 5 | GND | Ground |
| 3 | 4 | B0 | Data Ports |
| 4 | 3 | A | Data Ports |
| 5 | 2 | V _{CC} | Supply Voltage |
| 6 | 1 | S | Control Input |

TRUTH TABLE

| Control Input (S) | Function |
|-------------------|-------------------|
| Low | B0 connected to A |
| High | B1 connected to A |

FSA4157, FSA4157A

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Min | Max | Unit |
|---------------------|--|--|-----------------------|-----------|
| V _{CC} | Supply Voltage | -0.5 | 6.0 | V |
| V _S | DC Switch Voltage (Note 1) | -0.5 | V _{CC} + 0.5 | V |
| V _{IN} | DC Input Voltage (Note 1) | -0.5 | 6.0 | V |
| I _{IK} | DC Input Diode Current | -50 | | mA |
| I _{SW} | Switch Current | | 200 | mA |
| I _{SWPEAK} | Peak Switch Current (Pulse at 1 ms duration, < 10% Duty Cycle) | | 400 | mA |
| P _D | Power Dissipation at 85°C SC70 MicroPak | | 180 180 | mW |
| T _{STG} | Storage Temperature Range | -65 | +150 | °C |
| T _J | Maximum Junction Temperature | | +150 | °C |
| T _L | Lead Temperature (Soldering, 10 seconds) | | +260 | °C |
| ESD | Electrostatic Discharge Capability | Human Body Model, JESD22-A114 (FSA4157A) | | 7500 V |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Input and output negative ratings may be exceeded if input and output diode current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit | |
|--------------------|---------------------------------|----------------------|-----------------|------|------|
| V _{CC} | Supply Voltage | FSA4157 | 1.65 | 5.50 | V |
| | | FSA4157A | 2.7 | 5.5 | |
| V _{CNTRL} | Control Input Voltage (Note 2) | 0 | V _{CC} | V | |
| V _{SW} | Switch Input Voltage | 0 | V _{CC} | V | |
| T _A | Operating Temperature | -40 | +85 | °C | |
| θ _{JA} | Thermal Resistance in Still Air | SC70 | | 350 | °C/W |
| | | MicroPak (Estimated) | | 330 | |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

2. Control input must be held HIGH or LOW and it must not float.

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DC ELECTRICAL CHARACTERISTICS

(Typical values are at 25°C unless otherwise specified.)

| Symbol | Parameter | Conditions | V _{CC} (V) | Ambient Temperature | | | | | Unit |
|--|--|--|---------------------|---------------------|------|------|--------------|------|------|
| | | | | -25°C | | | -40 to +85°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| V _{IH} | Input Voltage High | FSA4157 Only | 1.8 to 2.7 | | | | 1.0 | | V |
| | | | 2.7 to 3.6 | | | | 2.0 | | |
| | | | 4.5 to 5.5 | | | | 2.4 | | |
| V _{IL} | Input Voltage Low | FSA4157 Only | 1.8 to 2.7 | | | | | 0.4 | V |
| | | FSA4157A Only | 2.7 to 3.6 | | | | | 0.4 | |
| | | | 2.7 to 3.6 | | | | | 0.6 | |
| | | | 4.5 to 5.5 | | | | | 0.8 | |
| I _{IN} | Control Input Leakage | V _{IN} = 0 V to V _{CC} | 2.7 to 3.6 | | | | -1.0 | 1.0 | μA |
| | | | 4.5 to 5.5 | | | | -1.0 | 1.0 | |
| I _{NO(OFF)} , I _{NC(OFF)} | Off Leakage Current of Port B0 and B1 | A = 1 V, 4.5 V, B ₀ or B ₁ = 4.5, 1 V | 5.5 | | ±2 | | -20 | 20 | nA |
| I _{A(ON)} | On Leakage Current of Port A | A = 1 V, 4.5V, B ₀ or B ₁ = 4.5, 1 V, 4.5 V or Floating | 5.5 | | ±4 | | -40 | 40 | nA |
| R _{ON} | Switch On Resistance | I _{OUT} = 100 mA, B ₀ or B ₁ = 1.5 V | 2.7 | | 2.6 | 4.0 | | 4.3 | Ω |
| | | I _{OUT} = 100 mA, B ₀ or B ₁ = 3.5 V | 4.5 | | 0.95 | 1.15 | | 1.30 | |
| ΔR _{ON} | On Resistance Matching Between Channels (Note 4) | I _{OUT} = 100 mA, B ₀ or B ₁ = 1.5 V | 4.5 | | 0.06 | 0.12 | | 0.15 | Ω |
| R _{FLAT(ON)} | On Resistance Flatness (Note 4) | I _{OUT} = 100 mA, B ₀ or B ₁ = 0 V, 0.75 V, 1.5 V | 2.7 | | 1.4 | | | | Ω |
| | | I _{OUT} = 100 mA, B ₀ or B ₁ = 0 V, 1 V, 2 V | 4.5 | | 0.2 | 0.3 | | 0.4 | |
| I _{CC} | Quiescent Supply Current | V _{IN} = 0 V or V _{CC} , I _{OUT} = 0 V | 3.6 | | 0.1 | 0.5 | | 1.0 | μA |
| | | | 5.5 | | 0.1 | 0.5 | | 1.0 | |
| ΔI _{CC} | Increase in I _{CC} per Input | One Input at 2.7 V, others at V _{CC} or GND (FSA4157A Only) | 4.3 | | 0.2 | | | 10.0 | μA |

3. Measured by the voltage drop between the A and B pins at the indicated current through the switch. On resistance is determined by the lower of the voltage on the two (A or B ports).

4. ΔR_{ON} = R_{ON max} - R_{ON min} measured at identical V_{CC}, temperature, and voltage.

5. Flatness is defined as the difference between the maximum and minimum value of on resistance over the specified range of conditions.

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AC ELECTRICAL CHARACTERISTICS

(Typical values are at 25°C unless otherwise specified.)

| Symbol | Parameter | Conditions | V _{CC} (V) | Ambient Temperature | | | | | Unit | Figure |
|------------------|-------------------------|---|---------------------|---------------------|-------|------|--------------|------|-----------|----------|
| | | | | -25°C | | | -40 to +85°C | | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| t _{ON} | Turn-On Time | B ₀ or B ₁ = 1.5 V, R _L = 50 Ω, C _L = 35 pF (FSA4157A Only) | 2.7 to 3.6 | | | 60 | | 65 | ns | Figure 8 |
| | | B ₀ or B ₁ = 1.5V, R _L = 50 Ω, C _L = 35 pF | 2.7 to 3.6 | | | 50 | | 60 | | |
| | | B ₀ or B ₁ = 1.5 V, R _L = 50 Ω, C _L = 35 pF | 4.5 to 5.5 | | | 35 | | 40 | | |
| t _{OFF} | Turn-Off Time | B ₀ or B ₁ = 1.5 V, R _L = 50 Ω, C _L = 35 pF | 2.7 to 3.6 | | | 20 | | 30 | ns | Figure 8 |
| | | B ₀ or B ₁ = 1.5 V, R _L = 50 Ω, C _L = 35 pF | 4.5 to 5.5 | | | 15 | | 20 | | |
| t _{BBM} | Break-Before-Make Time | FSA4157 | 2.7 to 3.6 | | | | | | ns | Figure 9 |
| | | | 4.5 to 5.5 | | 20 | | | | | |
| | | FSA4157A Only | 4.5 to 5.5 | | 25 | | | | | |
| Q | Charge Injection | C _L = 1.0 nF, V _{GE} = 0 V, R _{GEN} = 0 Ω | 2.7 to 3.6 | | 10 | | | pC | Figure 11 | |
| | | | 4.5 to 5.5 | | 20 | | | | | |
| OIRR | Off Isolation | f = 1 MHz, R _L = 50 Ω | 2.7 to 3.6 | | -70 | | | dB | Figure 10 | |
| | | | 4.5 to 5.5 | | -70 | | | | | |
| Xtalk | Crosstalk | f = 1 MHz, R _L = 50 Ω | 2.7 to 3.6 | | -70 | | | dB | Figure 10 | |
| | | | 4.5 to 5.5 | | -70 | | | | | |
| BW | -3db Bandwidth | R _L = 50 Ω | 2.7 to 3.6 | | | 300 | | MHz | Figure 13 | |
| | | | 4.5 to 5.5 | | | 300 | | | | |
| THD | Total Harmon Distortion | R _L = 600 Ω, V _{IN} = 0.5, f = 20 Hz to 20 kHz | 2.7 to 3.6 | | 0.002 | | | % | Figure 14 | |
| | | | 4.5 to 5.5 | | 0.002 | | | | | |

CAPACITANCE

| Symbol | Parameter | Conditions | V _{CC} (V) | Ambient Temperature -25°C | | | Units | Figure |
|------------------|-------------------------------|------------|---------------------|---------------------------|------|------|-------|-----------|
| | | | | Min. | Typ. | Max. | | |
| C _{IN} | Control Pin Input Capacitance | f = 1 MHz | 0.0 | | 3.5 | | pF | Figure 12 |
| C _{OFF} | B Port Off Capacitance | f = 1 MHz | 4.5 | | 12.0 | | pF | Figure 12 |
| C _{ON} | On Capacitance | f = 1 MHz | 4.5 | | 40.0 | | pF | Figure 12 |

FSA4157, FSA4157A

TYPICAL PERFORMANCE CHARACTERISTICS

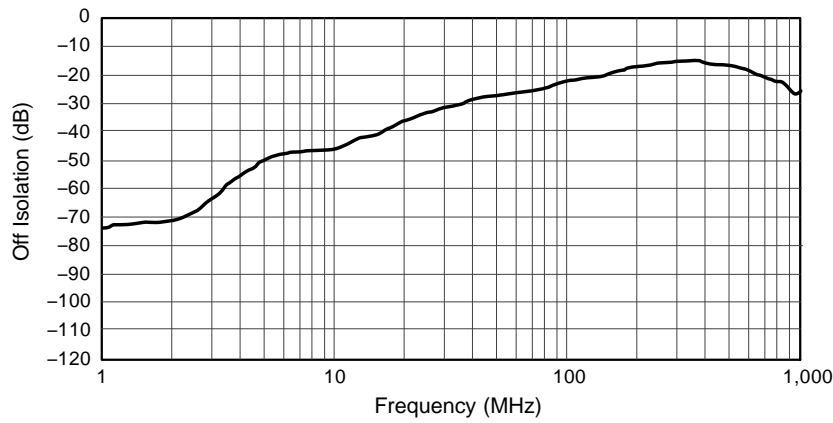


Figure 3. Off Isolation, $V_{CC} = 2.7\text{ V to }5.5\text{ V}$

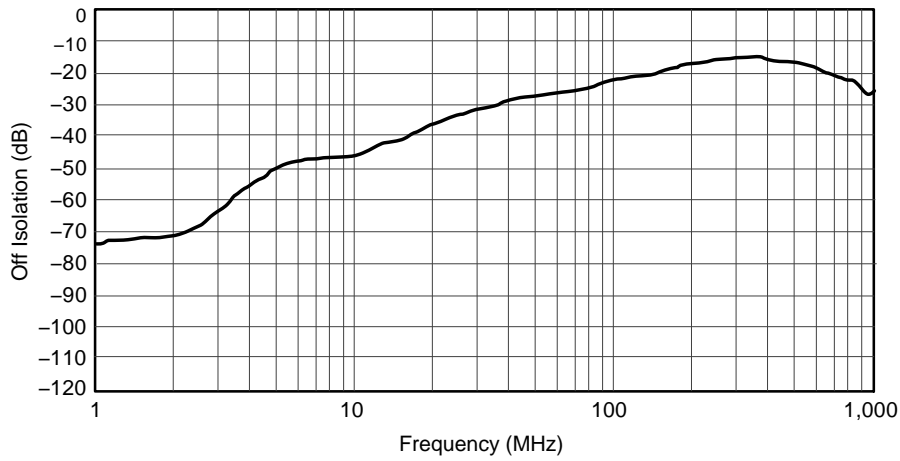


Figure 4. Crosstalk, $V_{CC} = 2.7\text{ V to }5.5\text{ V}$

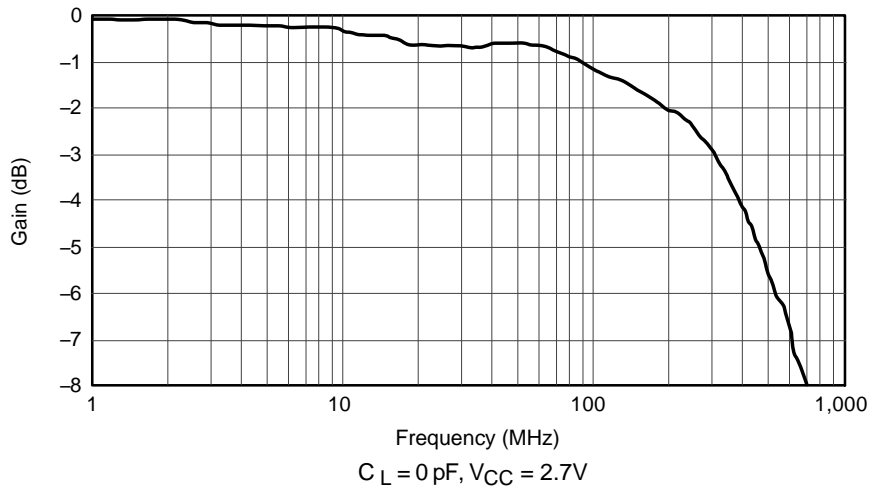


Figure 5. Crosstalk, $V_{CC} = 2.7\text{ V to }5.5\text{ V}$

FSA4157, FSA4157A

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

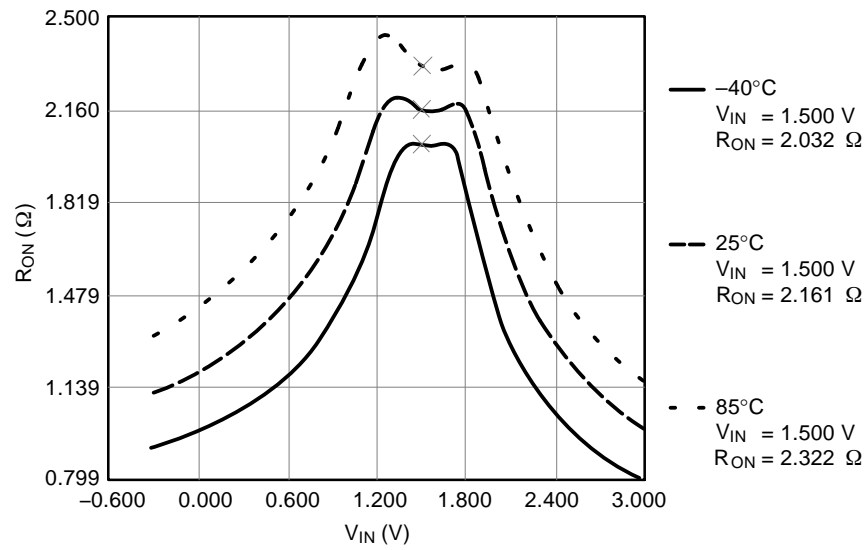


Figure 6. R_{ON} Switch On Resistance, $I_{\text{ON}} = 100\text{ mA}$, $V_{\text{CC}} = 2.7\text{ V}$

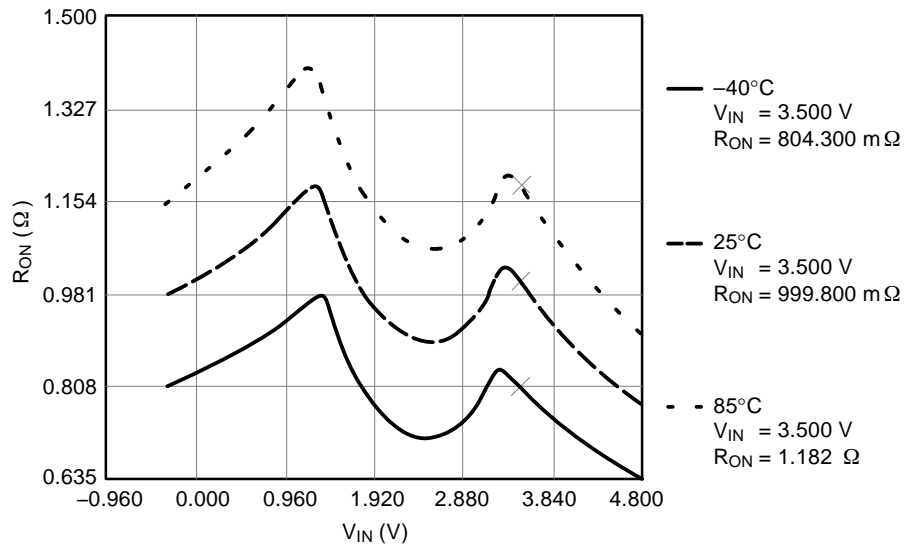


Figure 7. R_{ON} Switch On Resistance, $I_{\text{ON}} = 100\text{ mA}$, $V_{\text{CC}} = 4.5\text{ V}$

FSA4157, FSA4157A

AC LOADINGS AND WAVEFORMS

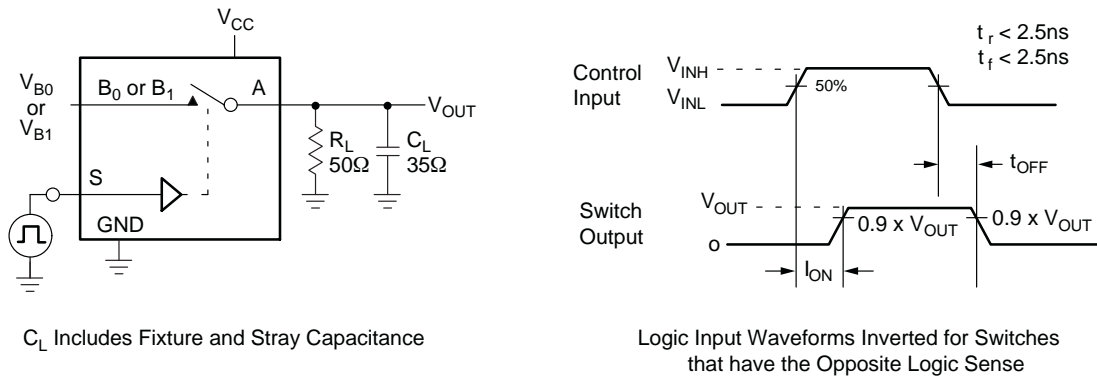


Figure 8. Turn On / Off Timing

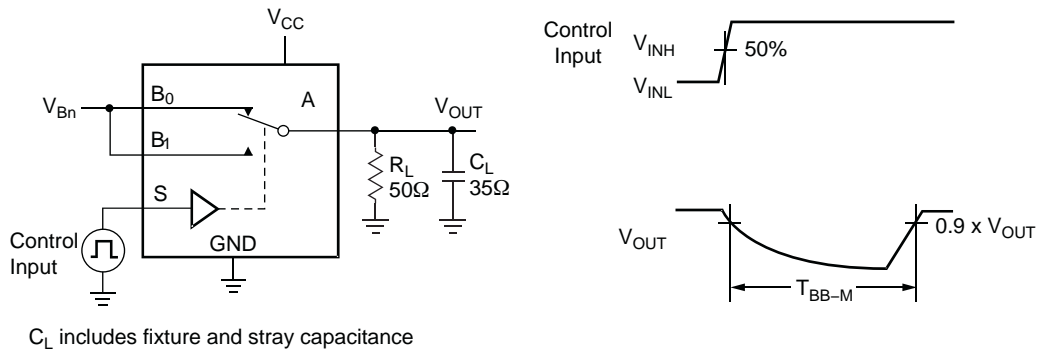


Figure 9. Break Before Make Timing

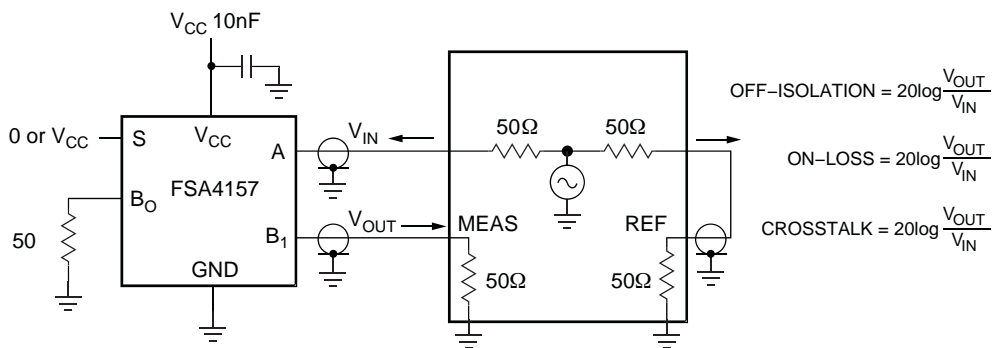


Figure 10. Off Isolation and Crosstalk

FSA4157, FSA4157A

AC LOADINGS AND WAVEFORMS (Continued)

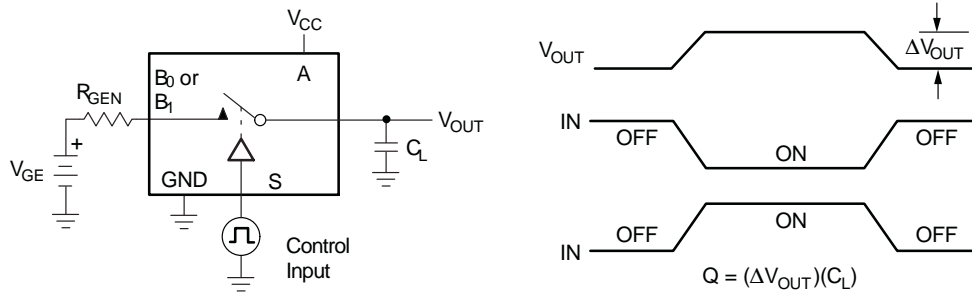


Figure 11. Charge Injection

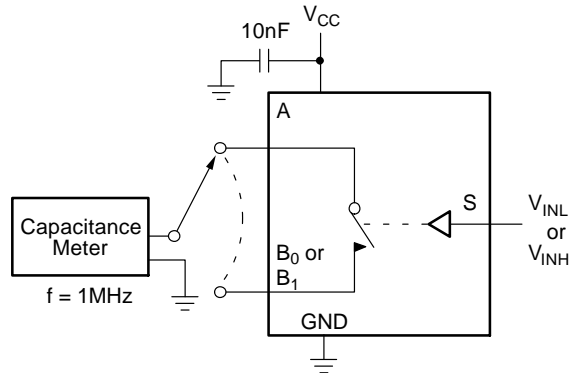


Figure 12. On / Off Capacitance Measurement Setup

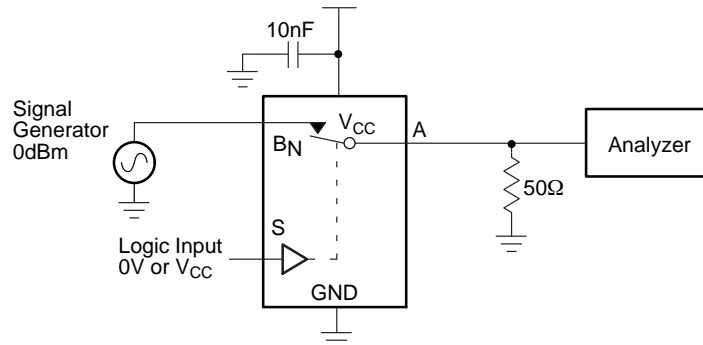


Figure 13. Bandwidth

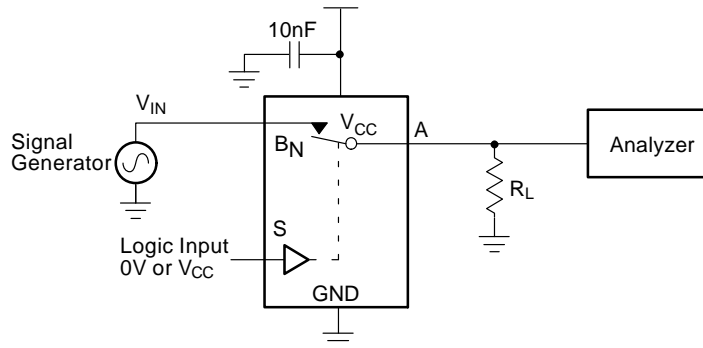


Figure 14. Harmonic Distortion

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MECHANICAL CASE OUTLINE

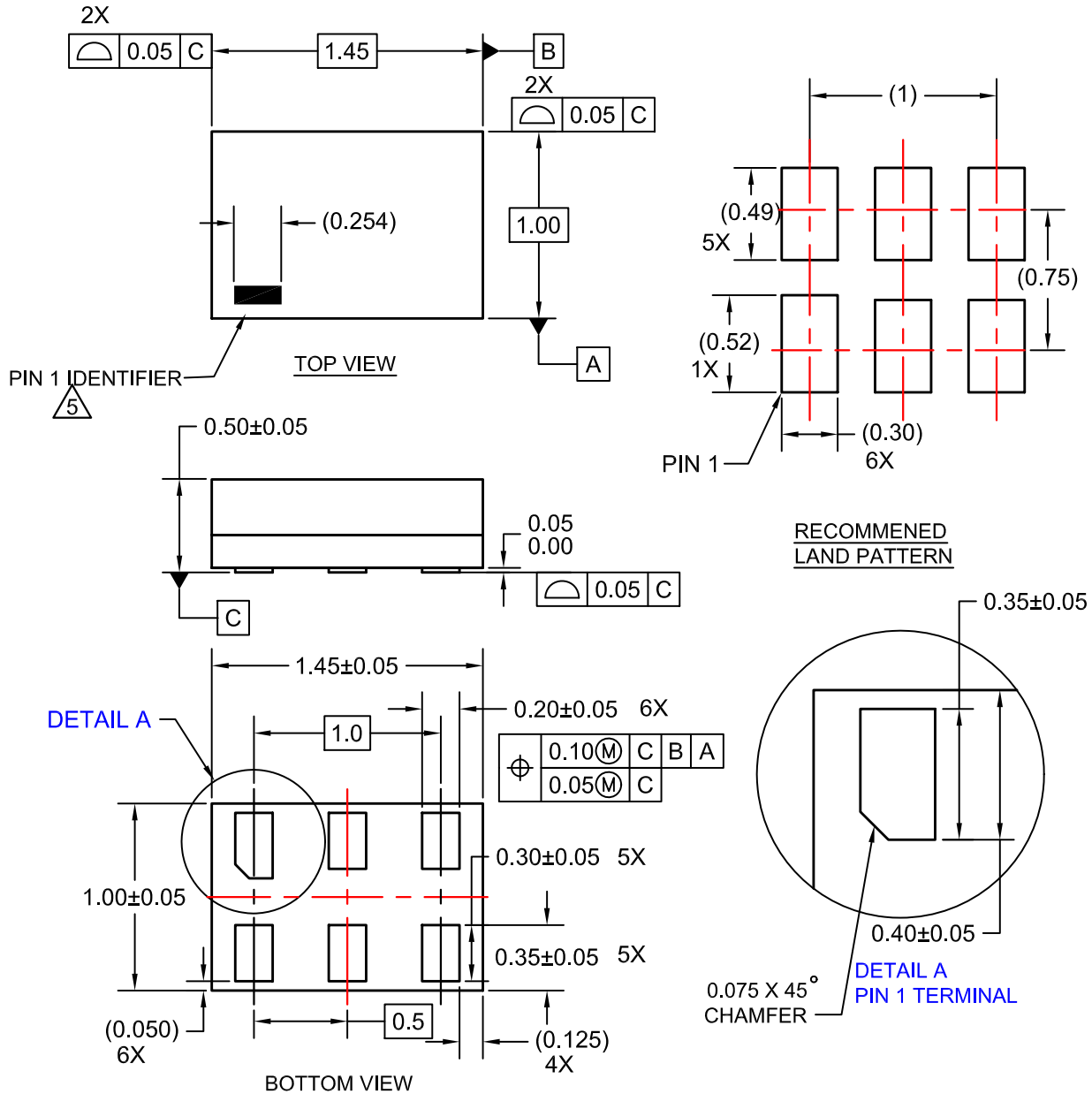
PACKAGE DIMENSIONS

ON Semiconductor®



SIP6 1.45X1.0
CASE 127EB
ISSUE O

DATE 31 AUG 2016



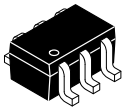
NOTES:

1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

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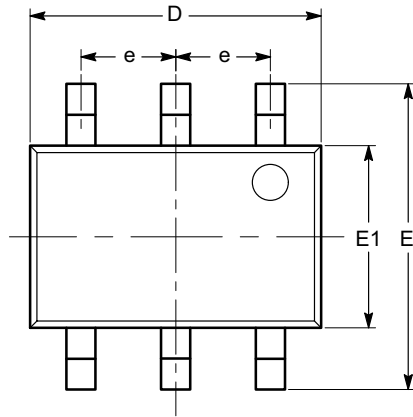
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS



1

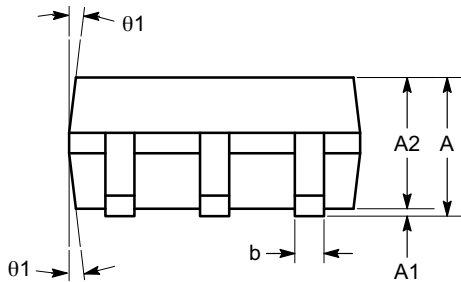
SC-88 (SC-70 6 Lead), 1.25x2
CASE 419AD
ISSUE A

DATE 07 JUL 2010

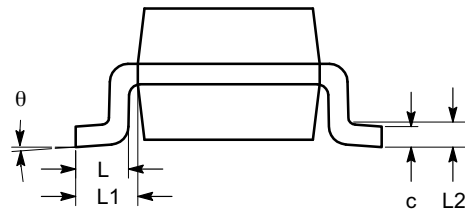


TOP VIEW

| SYMBOL | MIN | NOM | MAX |
|------------|----------|------|------|
| A | 0.80 | | 1.10 |
| A1 | 0.00 | | 0.10 |
| A2 | 0.80 | | 1.00 |
| b | 0.15 | | 0.30 |
| c | 0.10 | | 0.18 |
| D | 1.80 | 2.00 | 2.20 |
| E | 1.80 | 2.10 | 2.40 |
| E1 | 1.15 | 1.25 | 1.35 |
| e | 0.65 BSC | | |
| L | 0.26 | 0.36 | 0.46 |
| L1 | 0.42 REF | | |
| L2 | 0.15 BSC | | |
| θ | 0° | | 8° |
| θ_1 | 4° | | 10° |



SIDE VIEW



END VIEW

Notes:

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-203.

| | | |
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